DOCUMENT RESUME

ED 455 218 SP 040 143

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TITLE Brain Based Teaching: Fad or Promising Teaching Method.
PUB DATE 2001-04-13
NOTE 26p.
PUB TYPE Information Analyses (070)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Cognitive Processes; Elementary Secondary Education; *Learning Disabilities; *Special Education; Teaching Methods
IDENTIFIERS *Brain Based Learning; Neurosciences

ABSTRACT

This paper discusses brain-based teaching and examines its relevance as a teaching method and knowledge base. Brain-based teaching is very popular among early childhood educators. Positive attributes of brain-based education include student engagement and active involvement in their own learning, teachers teaching for meaning and understanding, and teachers immersing students in complex learning experiences. Educators who advocate brain-based teaching focus on cognitive teaching methods, using findings from the neurosciences. Since researchers focus their interest on early education because of the rapid development of synapses during the early years, brain-based teachers hope to develop learning experiences and an enriched environment that can stimulate synaptic growth. Special educators recognize the potential of discoveries within neuroscience for special education instruction. Various instructional approaches have proven beneficial for children with learning disabilities. Research shows that direct and cognitive intervention strategies can remediate learning problems among students with learning disabilities. Research also shows a correlation between neuroscience and brain based education, highlighting three facts: the brain learns best through repetition, the emotionality of an experience influences retention, and the plasticity of the brain allows instructors the possibility of improving student memory. (Contains 49 references.) (SM)

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ED 455 218

Brain based teaching: Fad or promising teaching method[i]

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Brain based teaching: Fad or promising teaching method

Abstract:

Today seminars on brain based education are attended by thousands of teachers across the United States. These teachers have in turn introduced brain based teaching into their classrooms. In this paper we discuss brain based teaching and examine its relevance as a teaching method and knowledge base. It concludes that although the research base is meager, there is neuroscientific research findings that can directly affect special education teaching practices.

Brain based teaching: Fad or promising teaching method

Educators are attending seminars around the nation to learn how to use brain-based education techniques in their classrooms. In addition, at most professional education conferences held around the nation we find at least one presentation purporting to provide educators with information on brain based teaching methods.

Although we see tremendous interest in brain based education among teachers, there is presently no research base on the application of brain -based learning in the classroom. As a result, much of what we hear is anecdotal. The meager research base for brain based learning makes it clear that we need to know if this method of learning is just an educational fad, or is it a teaching method that has great promise in enhancing the academic achievement of students across the nation.

Brain based teaching is very popular among many early childhood educators (Wolfe & Brandt,1998). Despite the

popularity among some educators, neuroscientists believe that it is premature to apply cognitive neuroscience findings directly to teaching (Bruer, 1997, 1998,1998,1999). Bruer (1997,1998) argues confidently that we cannot build a substantial bridge between neuroscience and early educator. He maintains that at this time early childhood education is best served by the application of cognitive teaching practices in the classroom rather than neurobiological findings (Bruer, 1997,1998, 1998).

Bruer (1997) presents two principal arguments why he believes that neuroscience has "little to offer education" at that juncture (p.4). Firstly, he argues that we actually know very little about brain development due to the fact that much of this research has been other animal subjects and therefore may not be fully transferable (Bruer, 1997, 1998). Consequently, Bruer (1997) advocates the view that early education is best served by the application of cognitive teaching practices to classroom teaching, rather than situating practice directly in neurobiological functioning.

Secondly, Bruer (1997) argues that neuroscientists do not have enough information about relationships between neural functioning and instructional practice. As a result, we can not make a number of claims (made by some educators)

concerning instructional practices, such as a critical learning period for humans, the role of enriched learning environments in early learning, and educational methods that stimulate synaptic growth (Bruer, 1997,1998a, 1999).

Bruer (1999) has modified his views toward brain-based education since 1997. Although he continues to maintain that the idea that critical periods for learning exist among humans is groundless, he has found many positive educational concepts associated with brain-based education.

Bruer (1999) has outlined a number of positive attributes of brain-based education. Bruer (1999) supports some aspects of brain-based education because these educators incorporate:

1. Contructivists models for learning and teaching
2. Student engagement and active involvement in their own learning;
3. Teachers teaching for meaning and understanding;
4. Rather than rote memorization;
5. Teachers creating classroom environments that are low in threat, yet high in challenge
6. Teachers immersing their students in complex learning experiences
7. Teachers using research to inform instructional practice;

8. Teachers judging what, and how research should be applied to their classrooms (Bruer, 1999).

The modification of Bruer's (1999) criticism of brain-based education provides considerable support to the possibility that brain based education may be more than an education fad.

Prior to Bruer modification of his views regarding brain based education, Bruer (1997) recognized that if brain based education had any ability to radically change educational practice and instruction, logically special education would be the first bastion

This statement is valid, because many special educators early applied the first cognitive theories of educational practice in the special education classroom (Bruer, 1997; McPhail & Palincsar, 1998; Moats & Lyon, 1993; Polloway & Patton, 1989). As a result it is only natural that he would assume that special educators would also find the findings of cognitive neuroscience to be applicable to teaching people with a learning disability.

Brain Based Education

Educators who advocate brain based teaching cast their instructional practice around cognitive teaching methods, based findings from the neurosciences (Brandt,1997; Diaz, 1992; Pool, 1998; Sylvester,1995; Winters, 1994; Wolfe &

Brandt, 1998). These researchers believe that they are justified in their educational ideas based on the plasticity of the brain (Bach-T-Rita,1990); evidence that IQ can be influenced by environmental factors; indicators that children can learn best during sensitive periods of the brain development; reports that emotion can influence learning (Winters,1994,1999,2000b); and MRI research findings (Bruer, 1997; Diaz, 1992; Jones,1995; Shaywitz,1996; Sylvester, 1995; Viadero,1996; Winters, 1994,1995,1999,2000; Wolfe & Brandt,1998).

Researchers focus their interest on early education because of the rapid development of synapses during the early years. Using this knowledge, brain based teachers hope to develop learning experiences and an enriched environment that can stimulate synaptic growth (Brandt,1997; Calvin, 1996; Cardellichio & Field, 1997; Caine & Caine,1997; Sylvester,1995).

Special Education and Brain-Based Learning

As shown in the early adoption of cognitive teaching methods to special education, special educators have long been innovators in applying new teaching techniques to special populations. In the 1960's special educators had speculated on the relationship of LD and Dyslexia to brain structure and functioning (Myklebust, 1964a, 1964b).

Developments in MRI made it possible to actually view brain activity while students were carrying out cognitive task (Bruer,1997; Diaz,1992; Jones,1995; Lyon & Rumsey, 1996; Lyon,Stewart & Freedman, 1989; Shaywitz, 1996; Viadero, 1996; Winters ,1994,1999). This process provides graphic evidence that during learning specific areas of the brain experience increased blood flow as a result of cognitive activity.

Dr. Angel Diaz, formerly of Chicago State University, was one of the first professional special educators to recognize the potential of discoveries of neuroscience in special education instruction. Some special educators also began to recognize that the findings of these researchers might inform educational practice in special education (Diaz, 1992; Winters, 1994, 1995,1999,2000).

Dr. Diaz (1992) called brain-based instruction: neurobiologic instruction. Neurobiologic instruction can be defined as the use of the neuropsychological knowledge we have of learning disabilities to center instruction toward stimulation of those parts of the brain that moderate behavior/ learning. In this way the teacher focus toward the specific centers of the brain that can lead to the remediation of the academic deficits exceptional children bring to the classroom. Dr. Diaz (1992) has observed that:

"Knowledge of the arrangement of the neural networks and the way the individual neuronal processes are connected, how they grow and develop, how their functioning is altered when they do not develop, how they tend to restructure themselves after they have been lessened or damaged, and how there operation can be modified by dietetic and psychopharmaceutical intake provides a wealth of information from which educators can derive teaching and/ or learning principles. The information can also provide educators with a more appropriate rationale for improving a child's learning efficiency and with improved techniques to identify and remediate learning problems" (p.31).

Some special educators in the late 1980's were especially interested in the implications of neuroscientific research to special education instruction due to developments in magnetic resonance imaging (MRI) and positron emission topography (PET). These brain-imaging techniques have transformed our under-standing of the way the brain works. This research has also shown us how learning effects changes in the brain (Shaywitz, 1997).

Brain imaging research has helped us to attain a greater understanding of the psychoneurological foundation

of LD processing problems (McPhail & Palincsar, 1998; Shaywitz, 1997; Shaywitz & Shaywitz, 1996). For example, in the area of reading MRI's have made it clear that many students with a learning disability are experiencing phonological processing problems (Shawitz & Shawitz, 1996). This finding supported the earlier research into the reading processing problems of children with learning disabilities resulting from neuropsychological testing of these children in the 1970's (*Fletcher, et al., 1974; Lieberman, et al., 1974).*

In using neurobiological learning the cognitive and direct teaching methods are both applicable (Winters, 1994,1999,2000). The cognitive approach emphasizes the individual as an active learner in control of his learning situation, with the teacher-facilitating student planning, self-evaluation and self-monitoring skills. This method is usually incorporated in learning strategies approaches that are basically psychoneurological.

Best Teaching Methods for LD Students

Various instructional approaches have proven to be beneficial for children with learning disabilities (Swanson,Carson & Sachse-Lee,1996). In a meta-analysis of 78 intervention studies, it was reported that there was a mean effect size of 0.85, from a total of 324 effect sizes

from this collection of studies on LD interventions ((Swanson,Carson & Sachse-Lee,1996). This effect size provides significant support for the view that instructional interventions can positively affect the literacy of LD students.

Effect Size and Teaching Method

A review of the LD intervention literature indicates that direct and cognitive instructional methods work well in the remediation of learning disabilities (Lyon & Moats,1993). In a study of LD intervention literature between 1967 and 1993, Swanson, Carson, and Sachse-Lee (1996) reported a mean effect size score of 0.91 for direct instruction and 1.07 for cognitive teaching methods.

Swanson and Hoskyn (1998) confirmed these findings indicating the success of direct and cognitive intervention strategies in the remediation of learning problems among children with learning disabilities. In a comprehensive meta-analysis of 180 intervention studies Swanson and Hoskyn (1998) report a 0.79 mean effect size for the experimental intervention studies included in their study.

The meta-analysis of intervention literature by Swanson and Hoskyn (1998) make it clear that all academic learning disabilities are responsive to treatment. The mean effect size for this analysis of intervention instructional

practices was 0.68 for direct instruction and 0.72 for cognitive teaching strategies (Swanson & Hoskyn, 1998). The high effect sizes for cognitive strategies instruction in the remediation of learning disabilities support the use of these strategies to enhance the academic achievement and performance of children with a learning disability.

The direct teaching method emphasizes the active effort of the teacher to structure the student's environment. The direct teaching method includes (1) grouping immediate instructional needs; (2) sequencing academic skills to be remediated; (3) model successful academic practice; and (4) pacing academic skills that encourage many response opportunities.

Cognitive Instructional Methods

Special educators long ago realized that a cognitive perspective in the design and implementation of appropriate interventions in LD encourages the use of strategies training in the brain based instructional program of many students with identified as learning disabled. The use of cognitive teaching strategies in teaching the learning disabled reader, for example, can help them become self-regulating problem solvers who endeavor to play both a key and significant role in their own learning (McPhail &

Palincsar, 1998). Research indicates that remediation of a reading disability through cognitive teaching methods makes literacy more meaningful to the learner, as they use metacognition to monitor and overcome their reading processing problem (McPhail & Palincsar,1998; Swanson, Carson & Sachse-Lee, 1996; Swanson & Hoskyn, 1998).

The regular educator has one principal objective in using teaching methods based on the findings of neuroscientists: stimulation of the learners brain (Bruer,1997).The special educator does not seek to only increase stimulation of the brain, s/he seeks to make the student with a learning difficulty a more efficient and capable learning. Educators therefore use neuropsychology and cognitive neuroscience research to find prescriptions that will remedy (make more manageable) the learning problems of students with a learning difficulty.

Cognitive development is the human capacity to represent mentally objects and events existing in the real world (McShane, 1991, p.121). Wong and Wong (1988) have observed that:

> "...the basic tenet in cognitive psychology, namely, the centrality of the student s' active participation in and responsibility for the learning" (p.26).

Teaching methods in special education are based on the paradigm of psychology--Skinner's notion of stimulus control, and the shaping and reinforcement of academic skills. The basic tenets of the cognitive teaching method are (1) the student must be an active participant in his learning, (2) students are responsible for their own learning, and (3) the teacher must inculcate in the students/ pupils planning, self-evaluation and self monitoring skills (Kavale, Forness, & Bender, 1988; Wong 1985a, 1985b, 1986; Wong & Wong 1988).

The research on the use of cognitive instructional methods in special education, makes it clear that exceptional children make tremendous gains while experiencing cognitive teaching methods (Wong, 1988; Keller & Hallahan, 1987). This research also illustrates that effective learning activities must be sensitive to the student's prior knowledge/ schemata and reflect eventual conditions of use of that knowledge.

The transfer of knowledge and skill to the exceptional student through the cognitive method make it necessary to teach the student knowledge and control of his own mental processes. This will help the exceptional student to become an active self-regulator of his learning. As a result, the special educator seeks to develop engaged learners who use

metacognition to improve and maintain what they have learned. Intelligent novices that use dialogue to make the learning strategies they have learned overt, explicit and concrete.

Moreover, even though there are constraints on cognitive-metacognitive teaching strategies, it is evident that they can be effective interventions for the exceptional child. But as educators we must remember that the cognitive teaching model is only one teaching method among many teaching approaches, that may help children with learning disabilities improve their academic performance.

Correlation between Neuroscience and Brain-Based Education

Brain imaging research has helped us to attain a greater understanding of the psychoneurological foundations of LD processing problems (McPhail & Palincsar, 1998; Shaywitz, 1997; Shaywitz & Shaywitz, 1996). For example, in the area of reading MRI's have made it clear that many students with a learning disability are experiencing phonological processing problems (Shawitz & Shawitz, 1996). This finding supported the earlier research into the reading processing problems of children with learning disabilities resulting from neuropsychological testing of

these children in the 1970's (Fletcher, *et al.*, 1974; Lieberman, *et al.*, 1974).

The neuroscientific findings have led to the development of new ways of teaching special populations .Shaywitz (1996) used neuroscience to find a new method of teaching people with dyslexia to become better readers.

Shaywitz (1996) developed the phonological model for dyslexia based on imaging research. The MRIs of dyslexics indicated to Shaywitz (1996) that many dyslexics fail to discriminate different sounds and as a result have a difficulty reading.

Using neuroscience tools helped him to recognize that by teaching some dyslexics phonemic awareness they could be more efficient readers.

In conclusion, it appears that brain-based learning may be more than the latest educational fad. The fact that MRIs indicated the possible location where cognitive functions were taking place relative to learning encouraged special educators to view several neuroscientific findings related to the brain applicable to special education. Results suggested 1) that the brain learns best through repetition; 2) the emotionality of an experience influences retention; and 3) that the plasticity of the brain allows instructors the possibility to improve student memory,

attention and learning processes through mental exercises (Diaz,1992; Winters,1994, 1995).

The evidence of a neurobiological signature for many learning problems, and the neuroscientific evidence that the structure of the brain can be change through learning make it clear that teaching methods based on these findings may help learning disabled children and adults learn more efficiently. Now that we know more about brain structure and function, and the plasticity of the brain, this knowledge base can advise instructional interventions that can positively influence the ability of individuals with LD to learn more efficiently. For example, research indicates that the use of pictures to present words and nouns, and colors to write words create emotion (Diaz, 1992).

The ability of new technology to provide instructors with insight into the processing problems experienced by people with a learning disability can inform future research. This makes it evident that future research should aim to develop, or identify and match existing learning strategies that can strengthen specific areas of the brain, to the specific disability of children diagnosed as ADHD and/or LD.

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[i] I would like to thank Read Diket, for her valuable comments on an earlier copy of this paper presented at the 2001 AERA annual Convention in Seattle.

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